

ABSTRACT
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Measurements of $T_c(Q,P)$: Depression of the Superfluid Transition Temperature by a Heat Current Along the Lambda Line, Yuanming Liu, Melora Larson, and Ulf Israelsson, Jet Propulsion Laboratory, California Institute of Technology.

We report experimental measurements of $T_c(Q,P)$ for heat currents (Q) between 1 and 100 $\mu\text{W}/\text{cm}^2$ and pressure (P) between SVP and 15 bar. The measurements were performed in a normal gravity environment, using the low-gravity simulator facility at JPL without the magnet being energized. The sample pressure was controlled to 0.1 μbar using a hot volume, and a Straty-Adams capacitive pressure gauge.¹ The total volume of helium in the sample cell and the hot volume was held constant using a pneumatic low-temperature valve. A melting curve thermometer (MCT) measured the transition temperature (T_c) with a resolution of about 10 nK through a sidewall probe of the thermal conductivity sample cell. We employed the same measurement technique and procedure described by DAS.² Preliminary results indicate that $T_c(Q,P)$ depends very little on the pressure in the pressure range between SVP and 15 bar with a variation in the amplitude of $T_c(Q,P)$ of less than about 5% observable in this pressure range. According to the Renormalization-group theory calculation by Haussmann and Dohm³, the amplitude of $T_c(Q,P)$ has a leading pressure-dependence term proportional to $\xi_0^{1/\nu}$, where ξ_0 is the correlation-length amplitude and ν is the correlation-length exponent. Thus, a small pressure dependence of the amplitude of $T_c(Q,P)$ is expected since ξ_0 is very weakly dependent on pressure between SVP and 15 bar, consistent with our measurements.

- 1) K. H. Mueller, Guenter Ahlers, and F. Pobell, "Thermal Expansion Coefficient, Scaling, and Universality near the Superfluid Transition of ^4He under Pressure", Phys. Rev. B14, 2096(1976).
- 2) Robert V. Duncan, Guenter Ahlers, and Victor Steinberg, "Depression of the Superfluid Transition Temperature in ^4He by a Heat Current", Phys. Rev. Lett. 60, 1522 (1988).
- 3) R. Haussmann and V. Dohm, "Depression of the Superfluid Transition in ^4He : Renormalization-group Theory", Phys. Rev. B46, 6361(1992).